



# ANALYSIS AND COMMENTS

Livestock Marketing Information Center

State Extension Services in Cooperation with USDA

Letter #33

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## REVISITING LONG TERM TRENDS IN LIVESTOCK WEIGHTS

### **Background**

The purpose of this analysis is to re-evaluate the long-term trends in slaughter cattle, hog, and sheep slaughter weights. Over time, livestock weight patterns tend to increase due to genetics and production practices (e.g. nutrition). The analysis utilizes annual slaughter data reported by the USDA National Agricultural Statistics Service for cattle, hogs, and sheep.

Federally inspected (FI) dressed and live weights in addition to commercial live weights reported from 1984 to 2003 were used in this analysis. The data used in the analysis includes the following average FI dressed weight categories: cattle, steer, heifer, cow, bull, hog, barrow/gilt, sow, boar/stag, and sheep/lamb weights. Commercial and FI live weights are only reported for cattle, hogs, and sheep/lambs.

This analysis employs a simple regression model to estimate the annual change in cattle, hog, and sheep dressed and live weights. Two regression models were used for each of the aforementioned species and categories. The first regression model utilized the actual weight data to estimate a yearly change in each weight category on a per pound basis. The second regression model utilized the percent change in yearly weights to approximate the yearly rate of change in each weight category.

### **Results and Discussion**

Overall, as expected, the results of the regression analysis confirmed that livestock weights have trended up. However, what is often not discussed but clearly shown in this analysis is that over time the annual rate of change in livestock weights has been rather modest and in many cases, such as with cattle and sheep weights, the annual rate of change may have moderated (or decelerated) in recent years. In addition, the results for cattle, hog, sheep/lamb weights were very similar to the results for the major sub-specie group (i.e. steer, heifer, barrow/gilt). Intuitively this was expected, as the major sub-species account for the greatest percentage of total slaughter, thus a key driver behind the average weight figures. It should be noted that all regression results were highly significant (based on a t-test) and the majority of the models reported an R-squared greater than 90 percent, thus a majority of the variability can be accounted for by simple trend analysis (i.e. time).

### ***Cattle Weights***

Based on the results from the regression analysis, cattle weights have a long-term positive (upward) trend. According to the results and as depicted in Figure 1, the trend for FI cattle weights on a dressed basis is around 5.91 pounds each year. FI steer dressed weights follow that same pattern with a gain of 5.27 pounds per year. The similarity between average cattle

and steer weight gains was expected as slaughter steers account for on average 49 percent of total FI cattle slaughter. Heifers tend to have a slightly greater gain each year with the estimated annual average increase at a little over 6 pounds. The results from this model for all cattle weight groups reaffirms the upward trend exhibited in cattle weights over time.

For this analysis, cow weights were not broken out into beef and dairy weights (data are not reported by USDA). On average, cow dressed weights over time had a trend increase of 3.69 pounds per year. This figure could be larger or smaller when the two categories of cow slaughter could be evaluated separately. The standard error would put the trend at a range of 3.20 to 4.20 pounds per year. The results of the model with bull dressed weights show a similar pattern. It should be noted, that for both models using FI cow and bull weights, the R-squared figures were slightly below 90 percent.

Over time, cattle weights have upheld an upward trend as evidenced in the prior results. Evaluating the data in terms of the rate at which cattle weights change compared to the prior year (or the percentage growth rate), the pattern in cattle weights is further confirmed. However, this trend is not as large as sometimes presumed (see Figure 2). In fact, the results indicate the year-to-year growth trend for average dressed cattle weights is a negative 0.04 percent. So, the growth rate in cattle weight is likely not increasing and may be decelerating (note that the standard error is 0.07). FI dressed weights for both steer and heifers exhibit a similar pattern, however, the rate at which weights increase does vary from the average trend for cattle. The rate at which FI dressed weights for change each year for steers is estimated at a negative 0.025 percent whereas the growth rate for heifers is about a negative 0.082 percent.

Analysis of both FI and commercial cattle live weights exhibited similar results for both regression models. Again, this is not unexpected as FI cattle slaughter typically accounts for about 98 percent of total commercial cattle slaughter. Results from the first regression model showed that on a live basis, FI weights trend upward around 8 pounds per year with the commercial trend a notch higher. On a per year basis, the growth rate pattern for both FI and commercial live weights rounds up to a negative 0.03 percent (note standard error of 0.05 percent). Again, the trend in cattle weights over time is upward moving but at a pace that may be moderating.

### ***Hog Weights***

The U.S. hog industry has undergone a number of changes in management and production practices during the 20 period selected for this analysis. Therefore, it is not surprising that the yearly trend in average hog weights on a dressed basis has been upward sloping. As shown in Figure 3, results from the first model utilizing actual annual hog weights indicate that FI dressed weights for hogs increase from 1.22 to 1.32 pounds each year (average minus and plus one standard error), with an average of 1.27 pounds. Similar to the relationship between cattle and steer weights, hog weights are heavily driven by slaughter barrow and gilt weights. This is confirmed in the results as FI barrow and gilt dressed weights increase annually at 1.44 pounds per year.

The time-trend in FI dressed weights for sows on an actual weight basis is estimated at 0.62 pounds per year. Based on the standard error, the range would be a third of a pound to almost a full pound. The R-squared for this model was extremely low, which suggest that there are other factors which also influence sow slaughter weight that were not identified in this simple regression analysis. This low figure may be explained by some large year-to-year and cyclical changes that occurred in sow weights during the selected time period. These larger shifts increase the amount of volatility in the annual weight dressed weight data. FI boar weights on a dressed basis resulted in some of the same concerns expressed regarding sow weights. The model estimated an upward sloping time-trend in boar and stag weights at one pound annually.

Results from the second regression model using yearly changes in FI hog dressed weights suggest hog weights increase at a rate of 0.025 percent each year (see Figure 4). That is, that

the rate of increase in hog weights may be accelerating. The results indicated barrows and gilts dressed weights have had an accelerating rate of growth of about 0.016 percent per year and sow dressed weights were at 0.049 percent. (Note that the standard errors on these coefficients were 0.02 and 0.07, for barrows and gilts and sows, respectively). In contrast, the growth rate for boar and stags dressed weights was estimated at a negative 0.016 pounds each year.

On a live weight basis, the regression analysis of both FI and commercial hog live weights exhibited essentially the same results as described above for both models. On an actual weight basis, FI and commercial live hog weights follow an upward sloping trend with a 1.11 and 1.12 pound increase per year, respectively. The similarity between the results was not unexpected as FI hog slaughter typically accounts for about 98 percent of total commercial hog slaughter. Both FI and commercial live weights are projected to accelerate at a rate of 0.012 percent per year.

### ***Sheep and Lamb Weights***

Slight changes in sheep and lamb weights can have a significant impact on lamb production in a given month or year compared to either beef or pork. Over time, FI sheep and lamb dressed weights trend upwards at approximately 0.56 pounds per year (see Figure 5). On a live weight basis, the regression model estimated FI sheep and lamb weights increase 1.16 pounds per year. For sheep and lambs slaughtered on a commercial basis, live weights were estimated to increase 1.23 pounds per year.

Compared to both cattle and hogs, were both FI and commercial live weights were nearly identical this result might seem questionable. However, the market for sheep and lamb has been undergoing subtle structural changes during the past few years. Recently, the distribution of sheep and lamb slaughter has exhibited a shift as FI slaughter is accounting for a smaller percentage of total sheep and lamb slaughter. Thus, it is not surprising that the model predicts an almost one pound difference in the yearly trend for FI and commercial sheep and lamb weights.

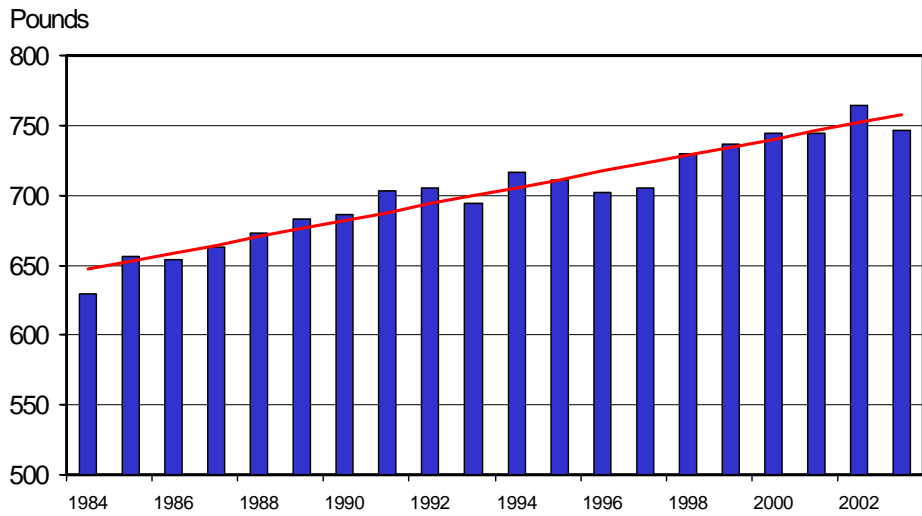
On a year-to-year basis, regression analysis indicates that the rate of change in FI sheep and lamb dressed weights was decreasing at a moderate rate of negative 0.078 pounds each year. Thus, even though sheep and lamb weights are increased, the rate at which weights increase each year appears to be dampening. On a live weight basis, the rate of growth for both FI and commercial sheep and lamb weights were nearly the same. Thus, despite the differences in results from the first regression model utilizing actual annual weights, year-to-year weight changes between FI and commercial data adhere to a similar pattern. The growth trend in sheep and lamb live weights is shown in Figure 6.

### **Some Final Comments**

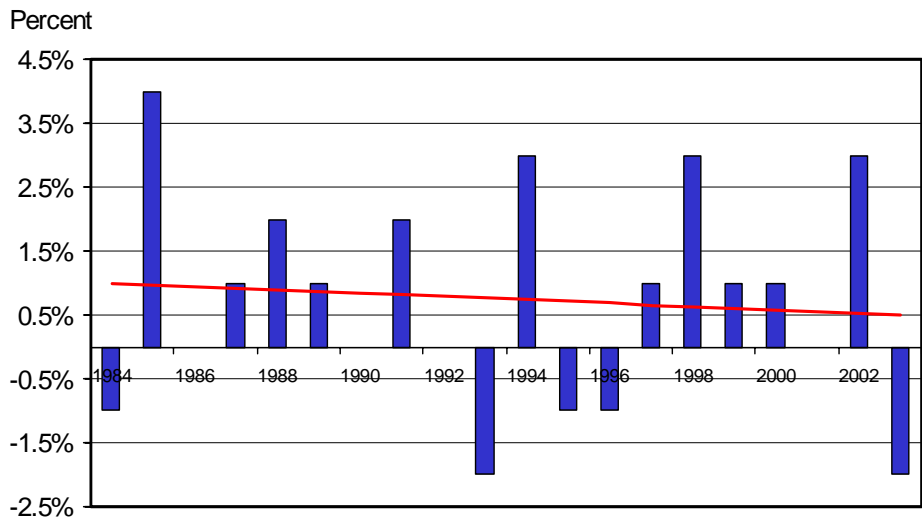
Over time, livestock weights adhere to a fairly consistent annual trend. There is some rather important annual variation due to factors such as weather conditions and annual marketing situations. For example, in cattle, the relatively large drop-off in cattle weights in 1993 was due to very severe winter weather conditions that had a major impact on feedlot performance. Also, the decline in cattle weights in 2003 was mostly due to accelerated feedlot marketings. Similar situations have occurred for other species.

Long-term trends in slaughter cattle, hog, and sheep dressed and live weights need to be re-evaluated periodically for analytical purposes. Typically, cattle, hog, and sheep weights will increase an average amount each year as supported in this analysis. However, the rate of acceleration or deceleration (trend in annual percent change) in weights also should be considered.

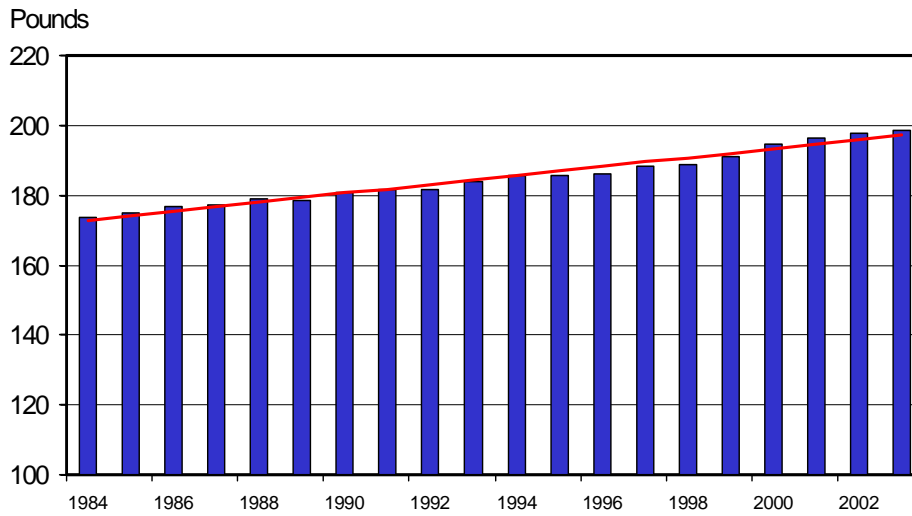
**Figure 1 - FI Average Dressed Cattle Weights  
Annual**



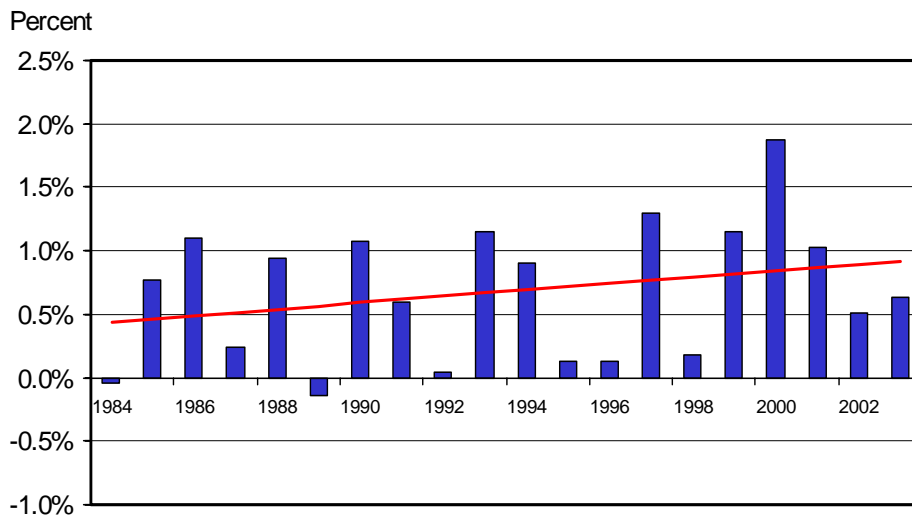
**Figure 2 - Annual Percent Change in FI Cattle  
Dressed Weights**



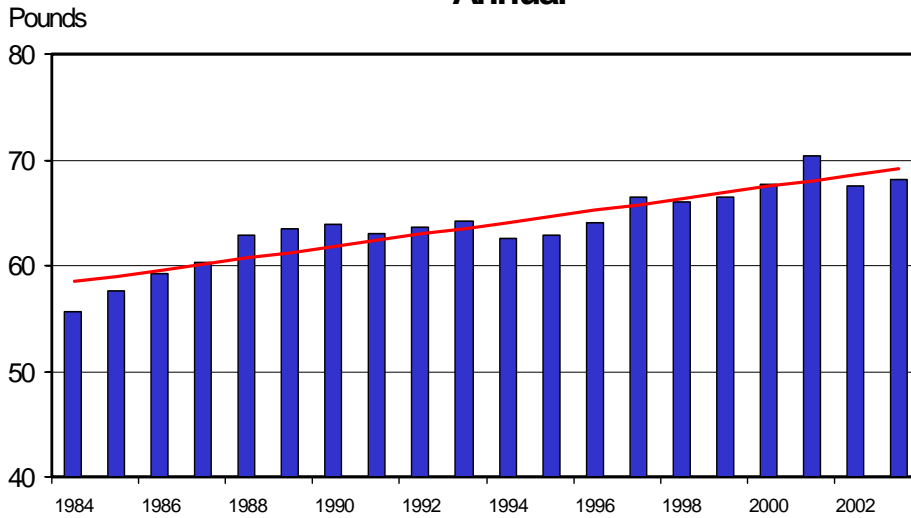
**Figure 3 - FI Average Dressed Hog Weights Annual**



**Figure 4 - Annual Percent Change in FI Hog Dressed Weights**



**Figure 5 - FI Average Dressed Sheep & Lamb Weights  
Annual**



**Figure 6 - Annual Percent Change in FI Sheep & Lamb Dressed Weights**

